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NATIONAL DAM SAFETY PROGRAM. DELAWARE LAKE DAM (NJ 00127) DELAW--ETC(U)
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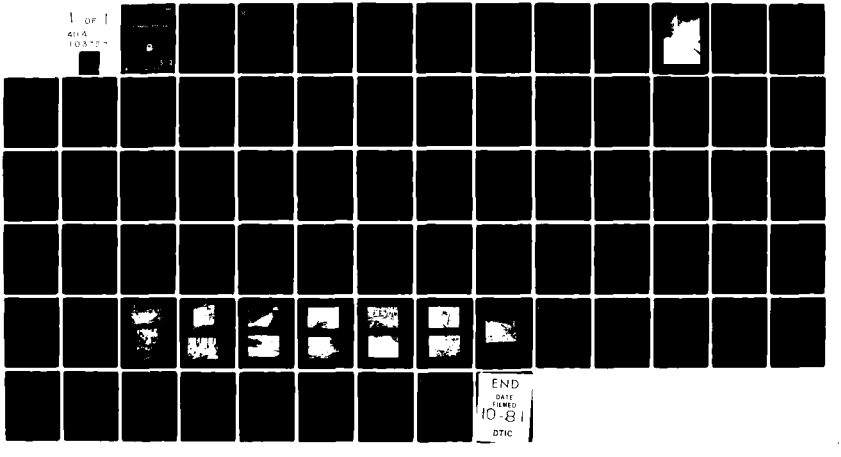

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DELAWARE RIVER BASIN
DELAWANNA CREEK, WARREN COUNTY
NEW JERSEY

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DELAWARE LAKE DAM
NJ 00127

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER: DAEN/NAP-53842/NJ00127-81/08/	2. GOVT ACCESSION NO.: AD-A103 757
4. TITLE (and Subtitle): Phase I Inspection Report National Dam Safety Program Delaware Lake Dam, NJ00127 Warren County, N.J.	5. TYPE OF REPORT & PERIOD COVERED: FINAL report
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s): Guinan, Warren, P.E.	8. CONTRACT OR GRANT NUMBER(s): DACW61-79-C-0011
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Anderson-Nichols 150 Causeway St. Boston, Massachusetts 02114	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS: NJ Department of Environmental Protection Division of Water Resources P.O. Box CN029 Trenton, NJ 08625	12. REPORT DATE: August, 1981
	13. NUMBER OF PAGES: 50
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): U.S. Army Engineer District, Philadelphia Custom House, 2d & Chestnut Streets Philadelphia, PA 19106	15. SECURITY CLASS. (of this report): Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

National Dam Safety Program. Delaware Lake Dam (NJ 00127) Delaware River Basin, Delawanna Creek, Warren County, New Jersey. Phase I Inspection Report.

18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia 22151.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams	National Dam Safety Program
Embankments	Delaware Lake Dam, N.J.
Visual Inspection	Seepage
Structural Analysis	Erosion

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report. → p 1

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DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—2 D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO

NAPEN-N

20 AUG 1981

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Delaware Lake Dam in Warren County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Delaware Lake Dam, initially listed as a high hazard potential structure, but reduced to a low hazard potential structure as a result of this inspection, is judged to be in fair overall condition. The dam's spillway is considered adequate because it will pass the 100-year spillway design flood. The low hazard potential classification means that in the event of failure of the dam, no loss of life and only minimal economic loss is expected. For the same reason no further studies or increase of spillway capacity are recommended. To assure continued functioning of the dam and its impoundment, the following actions could be undertaken by the owner:

a. Repair the erosion of the upstream slope of the dam, and provide erosion protection.

b. Evaluate seepage at the downstream toe of the dam to the right of the low-level outlet and provide remedial measures as needed.

c. Repair the erosion of the dam embankment on either side of the low-level outlet and the discharge channel downstream from the spillway.

d. Remove trees and brush from the dam.

e. Provide erosion protection for the toe of the dam from water flowing in the discharge channel downstream from the spillway and low-level outlet.

f. Repair spalled and cracked concrete spillway training walls.

g. Backfill animal burrows on the downstream slope.

h. Remove the outhouse from the dam and oversee excavation and backfilling of resulting excavation with suitable material.

i. Remove obstructions from the discharge channel downstream from spillway.

j. Start a program of periodically checking the condition of the dam and monitor the seepage to the right of the low-level outlet.

k. Control trespassing on the dam.

l. Clear trees and brush for 25 feet on either side of the spillway discharge channel for 100 feet downstream from the end of the spillway and also 100 feet downstream of the low-level outlet or to the property line whichever is the lesser distance and maintain the area clear of brush.

m. Replace the ladder rungs in the valve box. If this is not possible, remove them completely and provide other access to the gate valve as desired.

n. Develop written operating procedures and a periodic maintenance plan.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Courter of the Thirteenth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

NAPEN-N
Honorable Brendan T. Byrne

An important aspect of the Dam Inspection Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

ROGER L. BALDWIN
Lieutenant Colonel, Corps of Engineers
Commander and District Engineer

Incl
As stated

Copies furnished:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Regulation
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

DELAWARE LAKE DAM (NJ00127)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 22 April 1981 by Anderson-Nichols and Co. Inc., under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Delaware Lake Dam, initially listed as a high hazard potential structure, but reduced to a low hazard potential structure as a result of this inspection, is judged to be in fair overall condition. The dam's spillway is considered adequate because it will pass the 100-year spillway design flood. The low hazard potential classification means that in the event of failure of the dam, no loss of life and only minimal economic loss is expected. For the same reason no further studies or increase of spillway capacity are recommended. To assure continued functioning of the dam and its impoundment, the following actions could be undertaken by the owner:

a. Repair the erosion of the upstream slope of the dam, and provide erosion protection.

b. Evaluate seepage at the downstream toe of the dam to the right of the low-level outlet and provide remedial measures as needed.

c. Repair the erosion of the dam embankment on either side of the low-level outlet and the discharge channel downstream from the spillway.

d. Remove trees and brush from the dam.

e. Provide erosion protection for the toe of the dam from water flowing in the discharge channel downstream from the spillway and low-level outlet.

f. Repair spalled and cracked concrete spillway training walls.

g. Backfill animal burrows on the downstream slope.

h. Remove the outhouse from the dam and oversee excavation and backfilling of resulting excavation with suitable material.

i. Remove obstructions from the discharge channel downstream from spillway.

j. Start a program of periodically checking the condition of the dam and monitor the seepage to the right of the low-level outlet.

k. Control trespassing on the dam.

l. Clear trees and brush for 25 feet on either side of the spillway discharge channel for 100 feet downstream from the end of the spillway and also 100 feet downstream of the low-level outlet or to the property line whichever is the lesser distance and maintain the area clear of brush.

m. Replace the ladder rungs in the valve box. If this is not possible, remove them completely and provide other access to the gate valve as desired.

n. Develop written operating procedures and a periodic maintenance plan.

APPROVED: Roger L. Baldwin

ROGER L. BALDWIN
Lieutenant Colonel, Corps of Engineers
Commander and District Engineer

DATE: 26 Aug 81

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Delaware Lake Dam
Identification No.:	Fed ID No. NJ00127
State Located:	New Jersey
County Located:	Warren
Stream:	Delawanna Creek
River Basin:	Delaware
Date of Inspection:	April 22, 1981

ASSESSMENT OF GENERAL CONDITIONS

Delaware Lake Dam is a 53-year old structure, consisting of a concrete, broad-crested spillway and an earthfilled embankment with a concrete core wall. The dam is in fair overall condition. It is small in size and should be downgraded to low hazard from its initial classification of high hazard. Brush and small trees are growing on the upstream slope of the dam; the crest shows up to 8-in wheel ruts from trespass; and the downstream slope has many trees covering it with diameters up to 30 inches. Several deep animal burrows were found on the downstream slope. Both slopes have areas of erosion. The headwall of the 12-inch low-level outlet is cracked and spalled. Slight seepage was noted to the right (west) of the low-level outlet. The retreat channel from the spillway joins the low-level outlet channel and both discharge along the toe of the dam before turning a right angle away from the dam. The flowing water in this channel is cutting into the toe of the embankment. The spillway will pass the 100-year spillway design flood and is considered adequate.

Delaware Lake Dam does not pose a potential hazard to loss of life and only minimal property damage would occur if it should be breached. The downstream channel and bridge opening at the improved road crossing 1-1/2 miles downstream will pass the 100-year test flood but a small bridge on a dirt road about 1 mile downstream would be overtopped by about 2 feet. However, should the owner wish to maintain the integrity of the embankment he should retain the services of a professional engineer, qualified in the design and construction of dams to accomplish the following as specified and carry out the recommendations made by the engineer: In the near future: design or specify repairs for the erosion of the upstream slope of the dam, and design or specify erosion protection for the upstream slope of the dam; evaluate seepage at the downstream toe of the dam to the right of the low-level outlet and design remedial measures as needed; design or specify repairs for the erosion of dam embankment on either side of the low-level outlet and the discharge channel downstream from the spillway; specify and oversee procedures for removing trees and brush from the dam; design necessary remedial measures to prevent erosion of the toe of the dam by water flowing in the discharge channel downstream from the spillway and low-level outlet; design or specify

repairs to the spalled and cracked concrete spillway training walls; and backfill animal burrows on the downstream slope.

It is further recommended that the owner accomplish the following tasks as part of operational and maintenance procedures: Starting very soon: remove the outhouse from the dam and oversee excavation and backfilling of resulting excavation with suitable material; remove obstructions from the discharge channel downstream of the spillway; start a program of periodically checking the condition of the dam and monitor the seepage to the right of the low-level outlet; control trespassing on the dam; clear trees and brush for 25 feet on either side of the spillway discharge channel for 100 feet downstream of the low-level outlet or to the property line whichever is the lesser distance and maintain the area clear of brush; and replace the ladder rungs in the valve box or if this is not possible, remove them and provide other access to the gate valve as desired.

ANDERSON-NICHOLS & COMPANY, INC.

Warren A. Guinan

Warren A. Guinan, P.E.
Project Manager
New Jersey 16848

OVERVIEW PHOTO

DELAWARE LAKE DAM

22 April 1981

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonable possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

CONTENTS

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY REPORT

DELAWARE LAKE DAM FED ID NO. NJ00127

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY INSPECTION PROGRAM
DELAWARE LAKE DAM
FED ID NO. #NJ00127

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. Authority to perform the Phase I Safety Inspection of Delaware Lake Dam was received from the State of New Jersey, Department of Environmental Protection, Division of Water Resources by letter dated 12 December 1980 under Basic Contract No. FPM-39 and Contract No. A01093 dated 10 October, 1979. This Authority was given pursuant to the National Dam Inspection Act, Public Law 92-367 and by agreement between the State and the U.S. Army Engineers District, Philadelphia. The inspection discussed herein was performed by Anderson-Nichols & Company, Inc.

b. Purpose: The purpose of the Phase I Investigation is to develop an assessment of the general conditions with respect to the safety of Delaware Lake Dam and appurtenances. Conclusions are based upon available data and visual inspection. The results of this study are used to determine any need for emergency measures and to conclude if additional studies, investigations, and analyses are necessary and warranted.

1.2 Project Description

a. Description of Dam and Appurtenances. Delaware Lake Dam is a 18.3-foot high 515-foot long earthfill and concrete dam with a concrete core wall extending almost the entire length. The dam crest is approximately 10 feet wide with 2H:1V sloped earthen embankments upstream and downstream. The upstream embankment is grass and brush covered, while the downstream embankment has large trees growing along the entire length of the embankment. The dam crest is grass-covered with no trees or brush. The ungated concrete spillway extends from the concrete at the left abutment 50 feet to the right concrete training wall. There are four 0.8-foot piers spaced approximately 9 feet apart across the length of the spillway. The spillway is broadcrested with the upstream face vertical and the downstream face sloped 2H:1V. The downstream face has a concrete apron attached that extends about 40 feet downstream. The training wall on the right side extends 62 feet downstream to an earth berm that extends another 60 feet downstream. An operable 12-inch low level outlet is present. The control valve is on the downstream side of the core wall and located about 140 feet to the right (west) of the right spillway training wall.

b. Location. Delaware Lake Dam is located on Delawanna Creek in Knowlton Township, Warren County, New Jersey. The dam is shown on U.S.G.S. Quadrangle, Portland, New Jersey, with approximate coordinates of N40° 55.1' W75° 03.9'. The dam is located off of Interstate Route 80. A location map has been included as Figure 1.

c. Size Classification. Delaware Lake Dam is classified as being small in size on the basis of storage at top of dam of 370 acre-feet, which is less than 1000 acre-feet but more than 50 acre-feet, and on the basis of its height of 21.4 feet, which is less than 40 feet, in accordance with criteria given in the Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification. Delawanna Creek flows by a residential structure, located about 0.4 miles downstream of Delaware Lake Dam and elevated about 15 feet above the channel. There are also two roads, located about 0.9 miles and 1.5 miles downstream of the dam. It was determined that the 100-year test flood stage would be below the residential structure and below the top of the roads. Because there is not likely to be any significant property damage or loss of life, Delaware Lake Dam should be classified as low hazard.

e. Ownership. The dam is owned by Harold Buckman of Knowlton, Township, New Jersey; for information he can be reached by writing to Bridgeville Road, Belvidere, New Jersey, Box #185, 07823.

f. Purpose. The Delaware Lake Dam was built to increase the scenic beauty of the area and for recreation.

g. Design and Construction History. There are reproducible plans for Delaware Lake Dam dated 1929 and prepared by Edmund R. Halsey on file at the New Jersey Department of Environmental Protection, Prospect Street, Trenton, New Jersey 08625. The plans were verified in the field and are generally accurate. The only discrepancy is that the plans do not show the piers that are present in the spillway. These were put in during construction of the dam, apparently to be used in the construction of a bridge across the spillway. The bridge was not constructed and the piers were never taken out; however, four steel I-beam stringers have been laid over the piers and are used as a footbridge.

h. Normal Operational Procedure. No operational procedures exist for the dam. The owner regulates the level of the lake through use of a low level outlet. He has drawn the lake level down in the past when top soil was dredged from the upper end of the lake for loaming highway embankments during I-80 construction.

i. Site Geology. No site specific geologic information (such as borings) was available at the time the dam was inspected. Information derived from the Geologic Map of New Jersey (Kummel and Johnson, 1912) Geologic Map and Sections of Parts of the Portland and Belvidere Quadrangle, New Jersey-Pennsylvania (Drake, Epstein and Aaron, 1969) and Glacial Drift of New Jersey (Salisbury, Kummel, Peet and Whitson, 1902) indicates soils within the immediate site consist of stratified drift which may be comprised of sand and gravel plains, deltas, eskers, kames, and terraces.

No bedrock outcrops were observed during the dam inspection. The previously mentioned geologic map indicates that bedrock in this area consists of dark gray thin bedded claystone slate interbedded with medium to thick bedded graywacke and graywacke siltstone of Upper Ordovician age.

1.3 Pertinent Data

a. Drainage Area

2.60 square miles

b. Discharge at Damsite (cfs)

Maximum flood at damsite - unknown

Total ungated spillway capacity at maximum pool elevation (Top of dam) - 389

c. Elevation (ft. above NGVD)

Top of dam - 462.1

Design surcharge (unrouted) (100-year peak flow) - 461.8

Recreation pool (at time of inspection) - 460.0

Spillway crest - 460.0

Streambed at centerline of spillway - 441.7

Maximum tailwater (estimated) - 446

d. Reservoir (feet)

Length of maximum pool - 2500 (estimated)

Spillway crest - 2000

e. Storage (acre-feet)

Spillway crest - 307

Design surcharge (unrouted)(100-year peak flow) - 360

Top of dam - 370

f. Reservoir Surface (acres)

Top of dam - 50 (estimated)

Spillway crest - 38.4

g. Dam

Type - earthfill and concrete

Length - 515 feet

Height - 20.4 feet (hydraulic)

- 21.4 feet (structural)

Top width - 10 feet

Side slopes - upstream 2H:1V, downstream 2H:1V

Zoning - unknown

Impervious core - concrete

Cutoff - unknown

Grout curtain - unknown

h. Spillway

Type - Broadcrested concrete

Length of weir - 50 feet

Crest elevation - 460.0 feet NGVD

Low level outlet - One 12-inch reinforced concrete pipe (see 1.2i. below)

U/S Channel - Delaware Lake

D/S Channel - Delawanna Creek

i. Regulating Outlets

Type - one 12-inch diameter reinforced concrete low level outlet pipe

Length (estimated) - 70 feet

Access - along crest of dam to valve box on downstream side of core wall.

SECTION 2
ENGINEERING DATA

2.1 Design

No hydraulic, hydrologic, or other engineering design data were disclosed. The design plans on file at NJDEP show a 470 foot long earthfill dam with a concrete core wall 457 feet long. The plans also show a 12-inch reinforced concrete pipe for a low level outlet with a 4-inch RC pipe for a drain. The spillway for Delaware Lake Dam is also given in detail, excluding the four 0.8-foot piers which are present today. The design elevation of the dam is 463 feet NGVD with the spillway elevation at 460 feet NGVD. The plans also include cross sections and detail drawings for the entire dam.

2.2 Construction Highway

The original plans contain the estimated quantities of materials to be used for the dam construction. The spillway apron was recently repaired with 25 yards of concrete.

2.3 Operation

No data pertaining to the operation of the dam were found. The current owner stated that he operated the low-level outlet occasionally. He lowered the reservoir during construction of I-80 to enable dredging, in the upper end of the reservoir, for loam for highway embankments.

2.4 Evaluation

a. Availability. A search of the New Jersey Department of Environmental Protection Files, contact with community officials and contact with the owner revealed a limited amount of information. All disclosed information with a copy of the plans was retrieved.

b. Adequacy. The plans, supplemented by visual inspection, are deemed adequate to complete this inspection.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. Dam. Trees are growing on the crest of the dam, on the downstream slope and in the area of the downstream toe of the dam. The roots of several trees on the crest near the right abutment extend from the downstream edge of the crest to the upstream edge of the crest. Tire tracks up to 8-inches deep have developed along the crest of the dam. The crest surface is grass covered except for an area approximately 10 feet wide near the center of the dam which is covered with concrete, sand and gunite. The purpose of the gunite and sand repair was not determined during the site visit. Considerable erosion and sloughing has occurred on the upstream slope at and above the waterline. The upstream slope had extensive brush growing above the waterline and was only partially covered with riprap. An outhouse was constructed at the crest of the downstream slope near the right abutment.

Trees up to 2.5 feet in diameter are growing on the downstream slope and adjacent to the downstream toe of the dam. A series of three animal burrows up to 16 inches in diameter and up to 2.5 feet deep were observed on the downstream slope near the right side of the dam.

Erosion has occurred at the toe of the downstream slope adjacent to and right (west) of the low-level discharge pipe. A slight amount of seepage was noted at the toe of the slope where the discharge channel comes in contact with the embankment causing an 8-inch vertical escarpment to develop. The flow was clear with some orange staining present but no visible evidence of suspended fines.

b. Appurtenant Structures.

1. Ungated Spillway. The upstream end of the right spillway framing wall has cracked and the upstream end has been displaced by settlement. The upstream face of the left training wall is badly eroded at the waterline. Four vertical thru-wall cracks were observed in the right training wall downstream of the spillway. Also, the downstream end of the spillway at the junction with the downstream channel is broken. The surface of the left spillway training wall in the vicinity of crest is spalled and eroded up to 1/4" deep. The service footbridge, consisting of wideflange beam laid flat, is rusted.

2. Low Level Outlet. The 12" gate valve was reported operable at the time of inspection. The steel ladder rungs descending into the valve pit are badly rusted. The concrete headwall at the downstream end of the low-level outlet is cracked and eroded. Erosion has occurred on the downstream slope in the vicinity of the low-level outlet.

c. Reservoir Area. The watershed above the lake is gently to moderately sloping, with open fields and woods. The reservoir slopes appear to be stable. No evidence of significant sedimentation was observed.

d. Downstream Channel. Erosion of the soil bank has occurred on both sides of the spillway discharge channel immediately downstream of the spillway. Some trees and brush overhang the channel and portions of a concrete apron have broken off and been displaced downstream in the channel. Approximately 200 feet downstream from the dam, the discharge channel spreads out to cover a larger area and meanders adjacent to the downstream toe of the dam for approximately 75 feet to the right (west) of the low-level outlet.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures

No formal operating procedures were disclosed. Water level is controlled as the situation dictates.

4.2 Maintenance of Dam

No formal maintenance procedures for the dam were disclosed; but from its condition, it is apparent that some maintenance has been done on the dam to prevent serious deterioration of the structure. Trees were removed from the upstream embankment and 25 yards of concrete were applied to the downstream apron at the left side of the spillway. The upstream embankment has brush and small trees growing. The downstream embankment has large trees growing along the entire embankment.

4.3 Maintenance of Operating Facilities

No formal maintenance procedures for the operating facilities were disclosed. From the condition of the steel rungs of the ladder in the valve box leading to the low-level outlet valve, it appeared that a limited amount of maintenance had been done.

4.4 Warning System

No description of any warning system was disclosed.

4.5 Evaluation of Operational Adequacy

Because of the lack of operation and maintenance procedures, the remedial measures described in Section 7.2 should be implemented as prescribed.

SECTION 5
HYDROLOGIC/HYDRAULIC

5.1 Evaluation of Features

a. Design Data. Because no original hydrologic design data were revealed, an evaluation of such data could not be performed.

b. Experience Data. No experience data were revealed.

c. Visual Inspection. The spillway for Delaware Lake Dam consists of a 50 foot long concrete weir. No visual evidence was found of damage to the structure caused by overtopping. However, past discharges had been sufficient to cause the need for recent placement of about 25 yards of concrete to repair severe erosion in the downstream left (east) side of the spillway apron. At the time of inspection, approximately 0.1 foot of water was flowing over the spillway crest.

d. Delaware Lake Dam Overtopping Potential. The hydraulic/hydrologic evaluation for the dam is based on a selected Spillway Design Flood (SDF) equal to the 100-year flood in accordance with the range of test floods given in the evaluation guidelines, for dams classified as low hazard and small in size. The 100-year flood discharge was determined by Stephen J. Stankowski's method as outlined in "Magnitude and Frequency of Floods in New Jersey with Effects of Urbanization", Special Report #38, 1974. Hydrologic computations are given in Appendix 3. The 100-year discharge for the subject watershed is 343 cfs. The spillway capacity is 389 cfs and thus it can pass the 100-year flood without overtopping the dam embankment and is considered adequate.

e. Drawdown Capacity. If the low-level outlet currently in place is fully operable and free of siltation, it is estimated that the pond can be drained in approximately 20 days, assuming no significant inflow. This time period is considered very marginal for draining the reservoir under emergency conditions and drawdown should be supplemented by pumping.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. The slight seepage taking place through the dam to the right of the low-level outlet is indicative of seepage through the dam which, if not properly controlled, could lead to failure of the dam by piping or sloughing of the downstream slope. Similarly continued erosion of the toe by flow from the discharge channel could lead to continued sloughing of the toe and result in a failure of the embankment. Trees growing on the crest of the dam may blow over and pull out their roots, and this could lead to breaching of the dam because the crest is only several feet above the lake level. Similarly on the downstream slope, if a tree dies and its roots rot, seepage and erosion may take place along the root channels. Erosion of the upstream slope at the waterline will eventually lead to breaching of the dam if it is not controlled. Continued erosion of the right spillway banks, if not properly controlled, could cause undermining of the downstream toe of the dam.

6.2 Design and Construction Data

No design or construction data pertinent to the structural stability of the dam are available.

6.3 Operating Records

No operating records pertinent to the structural stability of the dam were available.

6.4 Post-Construction Changes

No records of post-construction changes are available except the recent repair to the spillway apron mentioned in Sections 4 and 5 above.

6.5 Seismic Stability

This dam is in Seismic Zone 1. According to the Recommended Guidelines, dams located in Seismic Zone 1 "may be assumed to present no hazard from earthquake provided static stability conditions are satisfactory and conventional safety margins exist." None of the visual observations made during the inspection are indicative of unstable slopes. However, because no data are available concerning the engineering properties of the embankment and foundation materials for this dam, it is not possible to make an engineering evaluation of the stability of the slopes or the factor of safety under static conditions.

SECTION 7
ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. Delaware Lake Dam is 53 years old and is in fair condition.

b. Adequacy of Information. The information available is such that the assessment of the dam must be based primarily on the results of the visual inspection.

c. Urgency. The recommendations made in 7.2.a and 7.2.b should be implemented by the owner as prescribed.

d. Necessity for Additional Data/Evaluation. The information available from the visual inspection is adequate to identify the potential problems which are listed in 7.2.a. These problems require the attention of a professional engineer who will have to make additional engineering studies to design or specify remedial measures to rectify the problems. If left unattended, the problems could lead to instability of the structure. Because the dam is low hazard, no further hydrologic studies are considered necessary.

7.2 Recommendations/Remedial Measures

a. Recommendations. The owner should retain a professional engineer qualified in the design and construction of dams to accomplish the following in the near future:

1. Design or specify repairs for the erosion of the upstream slope of the dam, and design or specify erosion protection for the upstream slope of the dam.

2. Evaluate seepage at the downstream toe of the dam to the right of the low-level outlet and design remedial measures as needed.

3. Design or specify repairs for the erosion of the dam embankment on either side of the low-level outlet and the discharge channel downstream from the spillway.

4. Specify and oversee procedures for removing trees and brush from the dam.

5. Design necessary remedial measures to prevent erosion of the toe of the dam by water flowing in the discharge channel downstream from the spillway and low-level outlet.

6. Design or specify repairs to the spalled and cracked concrete spillway training walls.

7. Backfill animal burrows on the downstream slope.

The owner should carry out the recommendations made by the engineer.

b. Operating and Maintenance Procedures. The owner should accomplish the following very soon:

1. Remove the outhouse from the dam and oversee excavation and backfilling of resulting excavation with suitable material.

2. Remove obstructions from discharge channel downstream from spillway.

3. Start a program of periodically checking the condition of the dam and monitor the seepage to the right of the low-level outlet.

4. Control trespassing on the dam.

5. Clear trees and brush for 25 feet on either side of the spillway discharge channel for 100 feet downstream from the end of the spillway and also 100 feet downstream of the low-level outlet or to the property line whichever is the lesser distance and maintain the area clear of brush.

6. Replace the ladder rungs in the valve box. If this is not possible, remove them completely and provide other access to the gate valve as desired.

In the near future:

Develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

Anderson-Nichols & Co., Inc. BOSTON MASSACHUSETTS	U.S. ARMY ENGINEER DIST. PHILADELPHIA CORPS OF ENGINEERS PHILADELPHIA, PA.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

DELAWARE LAKE DAM LOCATION MAP

DELAWANNA CREEK NEW JERSEY

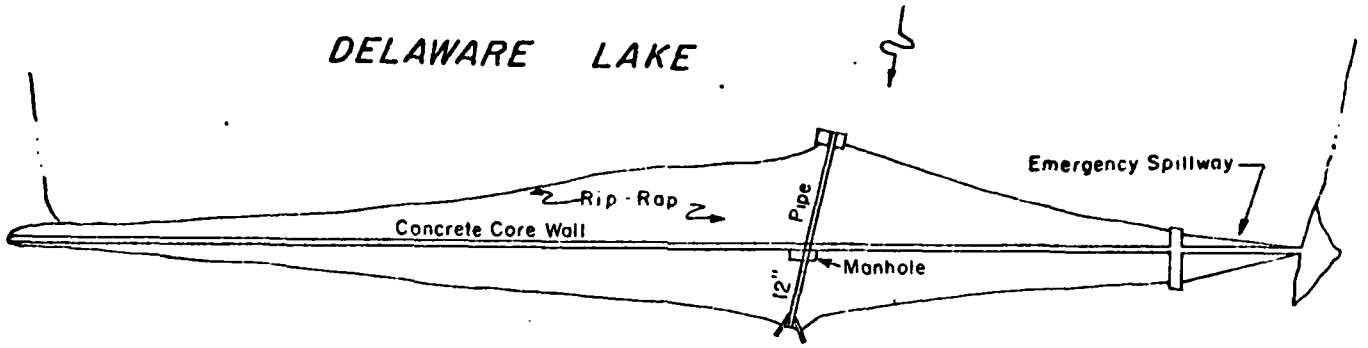
SCALE: 1" = 4 Miles Approx.

SCALE IN MILES

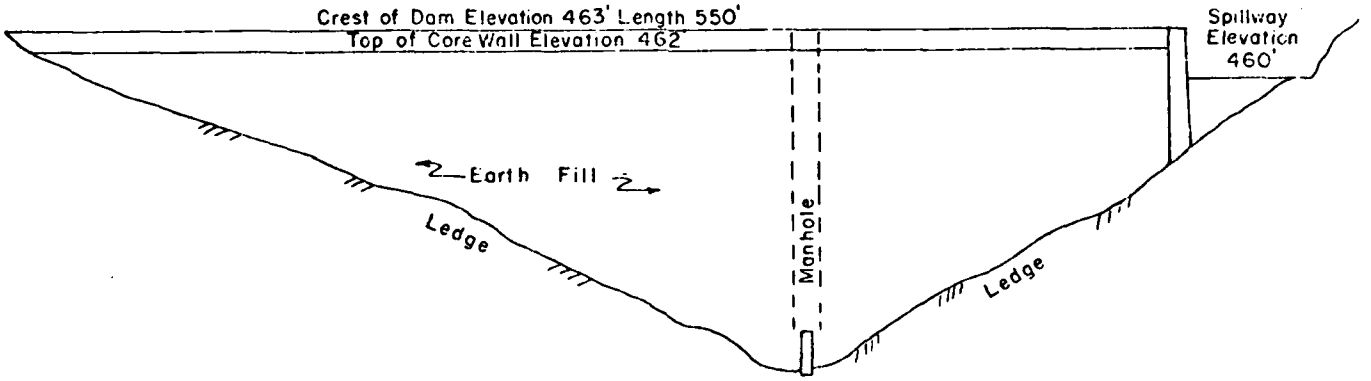
0 4 8

MAP BASED ON STATE OF NEW JERSEY OFFICIAL MAP & GUIDE.

FIGURE 1



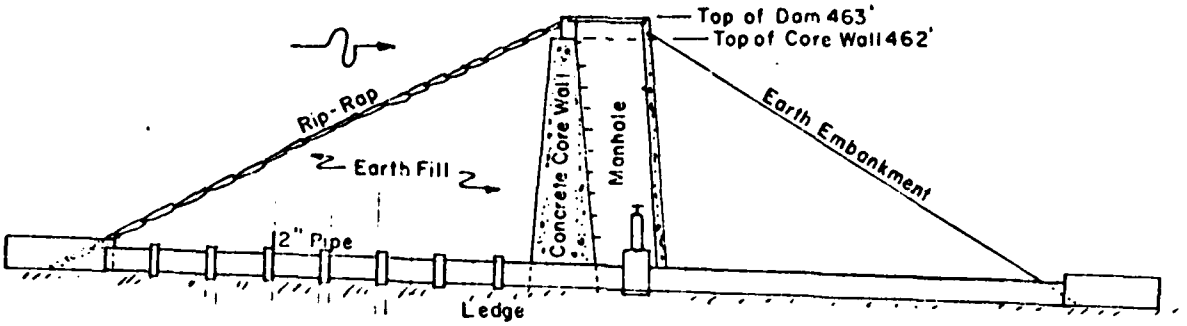
PLAN



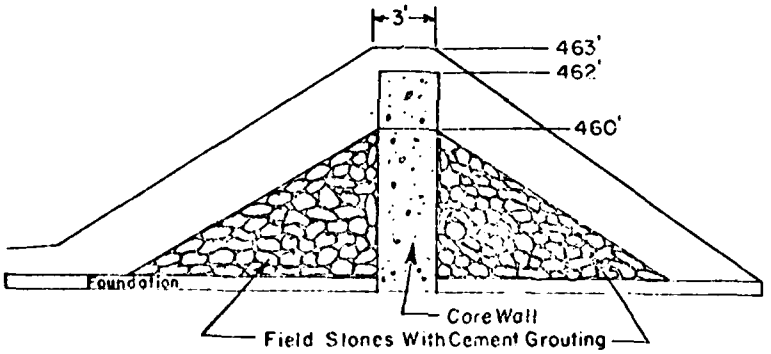
ELEVATION

Anderson-Nichols & Co, Inc BOSTON MASSACHUSETTS	U.S. ARMY ENGINEER DIST PHILADELPHIA CORPS OF ENGINEERS PHILADELPHIA, PA
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	
DELAWARE LAKE DAM	
DELAWANNA CREEK NEW JERSEY	
	SCALE NOT TO SCALE
	DATE JUNE 1981

FIGURE 2



PIPE CROSS-SECTION



SPILLWAY CROSS-SECTION

Anderson-Nichols & Co, Inc BOSTON MASSACHUSETTS	U.S ARMY ENGINEER DIST PHILADELPHIA CORPS OF ENGINEERS PHILADELPHIA, PA
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	
DELAWARE LAKE DAM CROSS-SECTIONS	
DELAWANNA CREEK	NEW JERSEY
	SCALE: NOT TO SCALE
	DATE: JUNE 1981

FIGURE 3

APPENDIX 1

ENGINEERING AND EXPERIENCE DATA

DELAWARE LAKE DAM

SAK

G Hiram BUCHMAN, Inc.

PUMP & WELL SUPPLIES

DELIVERING, N. J. 07033

PHONE: 679-0100

September 22, 1969

State of New Jersey
Dept. of Conservation
Div. of Water Policy
Box 1390
Trenton, N. J. 08625

Attention: Mr. Robert Hardman

Dear Sir:

RE: Delaware Lake - Dam
Application #141

In accordance with your recent letter, this is to inform you that the repairs on the above mentioned dam have been completed.

Very truly yours,

Harold A. Buchman

Mr. Peter L. Heimbach
96 Johnston Drive Est.
North Plainfield, New Jersey 07060

March 5, 1969 RECEIVED

MAR 10 1969

State of New Jersey
Department of Conservation & Economic Development
Trenton, New Jersey

Attention: Mr. Robert L. Hardman

REF: Application No. 141
Delaware Lake Dam

Gentlemen:

In regards to the above Dam Inspection, I would like to further clarify Item 7c General, "The crack in the southwest abutment face between the spillway and the earth dam shall be repaired in the near future". I intended that the repairs would be made within a year of the inspection, the owner has assured me that this will be done this summer.

I hope that this will allow the owner the necessary time to make the repair without further notification from the State.

Very truly yours,

Peter L. Heimbach, P.E.

PLH:ter

Mr. Harold A. Buchanan
G. Stra[illegible]
Belvidere, New Jersey 07823

RE: Delaware Lake
Dam Application No. 141

Dear Mr. Buchanan:

Your attention is [illegible] to my letters of Septem-
ber 9 and [illegible] you to apply for the
check in the [illegible] the project was to be
fore January 31, 1, 76.

We have had no [illegible] to our letters and by the
implementation of the [illegible] made by the
Bureau of [illegible] to grant [illegible]
ownership of the [illegible] to this office that the [illegible] collision
repair has been made to the dam.

Very truly yours,

Robert J. Hardaun, P.E.
Chief, Bureau of Water Control

SJS:slc:jm

December 10, 1968

Mr. Harold A. Buchman
O. Hiram Buchman, Inc.
Belvidere, New Jersey 07823

Re: Delaware Lake
Dam Application No. 161

Dear Mr. Buchman:

Your attention is invited to my letter of September 9, advising you to rep[illegible] the crack in the southwest abutment before November 15, 1968 and report the completion thereof.

We have not received the report to date and with this reminder, you are asked to submit the report on the completion of the repair of the crack in the southwest abutment before January 31, 1969.

Very truly yours,

Robert L. Hardman, P.E.
Chief, Bureau of Water Control

SAA:lc

November 9, 1948

Mr. Harold A. Bushman
G. Hiram Hamilton, Inc.
Salisbury, New Jersey 08023

RE: Dam Name Lake
Dam Application No. 111

Dear Mr. Bushman:

Thank you for your letter of August 31, forwarding a report, by Mr. Heinbach, Professional Engineer, on the existing conditions of the subject dam.

Mr. Heinbach in his report states that "There are several small bootlegged cracks on the front of the spillway which do not appear to require immediate repair. These cracks should be checked periodically and any increase in size would require further attention. The crack in the west abutment face between the spillway and the earth dam should be repaired in the near future. This crack appears to allow water to seep into the earth section of the dam when there is several inches of water flowing over the spillway. The action of this water and freezing in this crack would lead to damage of both the earth fill section of the dam and to the spillway."

Please arrange to repair the crack in the southwest abutment not to November 30, 1948 and report the completion, thereof, to this office, and also keep the small cracks under surveillance and advise this office if you notice any increase in their size.

Very truly yours,

Robert L. Hardman, P.E.
Chief, Bureau of Water Control

RLH:pk

ANNUAL REPORT - DAMS

Application No. 161
Belvidere Lake Dam

For 1968
Inspected on
August 17, 1968

Owner: Harold A. Buchman
G. Hiram Buchman, Inc.
Belvidere, New Jersey

Description of condition of the following:

1. Embankment. There is no evidence of erosion and no evidence of water seepage in any area of the dam. The entire earth fill section of the dam is overgrown with trees and brush.

2. Spillway. The concrete structure is generally in good condition. There are some cracks in the concrete floor of the spillway. Also, one large crack in the concrete abutment on the southwest end of the spillway between the spillway and the earth fill dam. No timber is used in the spillway. Minor seepage from one settlement crack in the spillway concrete floor was noted. No under spillway seepage was seen.

3. Emergency spillway. None.

4. Outlet works. The dam has a gate valve and outlet pipe through the base of the dam to the outlet stream. The valve is contained in a concrete vault and is operatable.

5. Inlet stream. The inlet end of the lake is silted for an area of approximately 3 acres. Average depth in this area is 3 feet.

6. Outlet stream. There are no signs of scouring or undercutting of the dam. No stilling basin is incorporated in the spillway, however, the boulder strewn stream bed

prevents scouring at the stream and the toe of the dam. The dam is protected by a concrete wall and dike downstream of the spillway where the outlet stream flows generally parallel to the toe of the dam.

7. General.

a. The owner reports that the dam has never been overtopped.

b. None

c. There are several small settlement cracks on the floor of the spillway which do not appear to require immediate repair. These cracks should be checked periodically and any increase in size would require further study. The crack in the southwest abutment face between the spillway and the earth dam should be repaired in the near future. This crack appears to allow water to seep into the earth section of the dam when there is several inches of water flowing over the spillway. The action of this water and freezing in this crack could lead to damage of both the earth fill section of the dam and to the spillway.

Inspected By

Peter L. Heimbach

Peter L. Heimbach
N.J.P.E. # 15518

Report on [illegible] inspection.

BAILEY UPPER DAM

Application No. 141.

Location 24.2.14.4.4.

On October 15, 1929 inspection was made of this dam.

The dam has been completed in accordance with the plans approved February 13, 1929 with the following exceptions:

The downstream fill has not yet been graded and settled and some additional fill remains to be placed behind the right wing wall at the spillway.

Eight inch piers for the support of a bridge have been placed in the spillway. These piers were not shown on the approved plan, but the length of the spillway has been increased, and now has a clear opening of 52.8'. This construction gives a spillway capacity of 200 sec. ft. per square mile as compared with 141 provided by the approved design.

It is recommended that the dam be not accepted until the work on the downstream slope is completed.

Water stood 2' below the spillway crest.

Trenton, N. J.,
October 16, 1929

John N. Brooke,
Assistant Division Engineer.

Form W-66-00-10-00

Dam Application No. 141

State of New Jersey

Department of [illegible]

To the Board of [illegible] and Inland Permit,
State of New Jersey

Gentlemen:

The application of Edmund B. Haley

filed February 1, 1929 for approval of plans and for a permit to construct a dam known as Haley Upper Dam near Delaware on Delaware Brook, tributary to Delaware River in Warren County, New Jersey, has been examined by John H. Brooks, Hydraulic Engineer.

PRINCIPAL FEATURES

Location 24.2.2.4.4 Site inspected February 5, 1929.

Purpose of dam beautification of private estate.

Drainage area 2.6 sq. mi.

Area of lake 30 acres. Capacity of lake 53 Mill. gals.

Type of dam earth fill, concrete core-wall Top width 6 feet.

Upstream slope 2 : 1 Downstream slope 2 : 1.

Length of dam 470 ~~450~~ feet. Rev. 20,1929 Max. height 14 17 Rev. 20,1929. feet.

Foundation material " slate rock.

Type of spillway masonry notch. c = 2.6 Length of spillway 50 feet.

Max. head on spillway 2.5 feet. with 6" freeboard.

Spillway capacity 198 sec. ft. per sq. mi.

Outlets other than spillway 1-12" terra cotta pipe with reinforced concrete envelope. ~~Gate controlled down stream end.~~

It has been found that the site for the dam is suitable and the plans adequate to insure the construction of a structure which will not be a menace to life or property. It is therefore recommended that the plans be approved and that a permit be issued, subject, however to the following terms and conditions:—

1. That this permit does not give any property rights, either in real estate or material, nor any exclusive privileges; neither does it authorize any injury to private property nor invasion of private rights, nor any infringement of Federal, State or local laws or regulations; nor does it waive the obtaining of Federal assent, when necessary.

2. That the work shall at all times be subject to supervision and inspection by representatives of the Department of Conservation and Development and that no changes in the plans or specifications as approved herein shall be made except with prior written consent of the Department, however, in case it is found necessary to make changes in the plans or specifications during the progress of the work, application for such changes must be made to the Department by the person holding this permit and such changes must be approved in writing before they become effective.

3. That the work shall be under the direction of a competent engineer, and that he or a competent representative shall be on the ground daily during the construction and until the completion of the dam.

4. That the Department shall be notified in advance of the proposed time of the commencement of this work, that no material shall be placed on any portion of the foundation until such portion of the foundation has been approved in writing by a representative of the Department.

5. That a report, on forms to be submitted by the Department, on the status of the construction work shall be mailed to the Department of Conservation and Development, State House Building, Trenton, New Jersey, on the 21st day of each month until the work upon the dam has been completed.

6. That no brush or waste timber cleared from the area under this approval shall be burned unless and until the party doing the work shall have obtained a permit from the Firewarden of the district in which the burning is to be done, in accordance with Section II, Chapter 123, P. L. 1906.

7. That the work shall be started within six months from date of this permit and completed within one year from said date; otherwise, this permit, if not previously revoked or specifically extended, shall cease and be null and void.

8. That the top of the core-wall shall be carried up to elevation 459.0 and the top of the earth fill [illegible] and spillway wing wall to elevation 400.0 making the depth of the spillway notch 5.0 feet.

9. That the gate valve in the blow-off pipe shall be placed in a concrete manhole at the downstream side of the core-wall.

10. That no flash boards or other obstruction shall be placed or permitted to remain on the crest of the spillway.

Trenton, New Jersey,

February 6, 1922

John N. Brooks
Hydraulic Engineer.

H. T. Critchlow
Chief, Division of Waters.

Recommended by Water Committee

Feb. 13, 1922.

Report on [illegible]

[illegible] Dam

Application No. 1141

Location [illegible]

On February 5, 1929, in company with Mr. Samuel R. Halsey, owner, and Mr. M. E. Johnson, Assistant State Geologist, inspection was made of this dam site.

The site is in a rather narrow valley and the watershed hilly and about one-tenth wooded, the remainder being in hay.

The foundation material is a sandy slate rock which outcrops in the stream bed and on the side hills. The overburden of glacial till with boulders appears to be light and there should be no difficulty in reaching bed rock with the footing for the core wall.

The site is approved for an earth dam having a concrete core wall.

John R. Brooks.

John R. Brooks
Hydraulic Engineer.

Trenton, New Jersey,
February 6, 1929.

Dam Application No. 141 Erie
Halsey Upper dam 2/11/29

Core wall, earth slopes and manner of compacting OK.

Spillway

Width shed 2.6 sq mi.

Spillway 22' long Elev. 457

Top of core wall 458

Top of dam 459

C = 2.6

Capacity with water at top of core wall

$Q = 2.6 \times 50 \times 1^{3/2} = 130$ cu ft

= 50 cu ft per sq mi

With dam crumb

$Q = 2.6 \times 50 \times 2^{3/2} = 368$ cu ft

2.828

= 141 cu ft per sq mi

Too small

Raise crown to Elev. 459

" top of dam to " 460

Capacity with water at top of core wall 141 sq mi

with 6" flashboard

$Q = 2.6 \times 50 \times 2.5^{3/2} = 513$ cu ft

3.46

= 198 cu ft per sq mi

EDMUND H. HALSEY
CIVIL ENGINEER AND SURVEYOR
[illegible]
NEWARK, N. J.

[illegible], 1934.

[illegible]

The Department of Conservation
and Development,
Division of Waters, State Office Building,
Trenton, New Jersey.

Gentlemen:-

There is a brook running through my property at Delaware, Hamilton Township, [illegible] New Jersey, upon which I wish to construct two [illegible] to raise the present water supply. I [illegible], but the same would not [illegible] the [illegible] and the like, and therefore, I would [illegible] that you issue permits for the two dams. [illegible] will be well within my property and will not [illegible] any one else to any extent, the following is the data [illegible] the same:

	Upper Dam	Lower Dam
Area of watershed	2.66 sq. mi.	2.33 sq. mi.
Maximum depth of pond	16 feet	22 feet
Area of water surface	30 acres	40 acres
Capacity of spillway by Francis formula	1 ft head 1.8 load 1000 cfs	1.8 ft head 2.0 load 1000 cfs
Capacity of drain pipe by Cooley's formula, Bul. 648, U.S. Dept of Agri.	15 ft head 18" pipe 13 cfs.	22 ft head 18" pipe 16 cfs
The character of foundation is	Slate	Slate

I expect to build these dams myself, using native gravel of those parts in the proportion of 1 - 2 - 4, unless I can get a run of gravel which will be satisfactory without screening the same. I also wish to make the earth fill by spreading the same in about six inch layers and running over it with tractors in the course of filling, which will thoroughly compact the same.

I would like to start this work at as early a date as the weather permits, and therefore, would like to have you act as soon as you can conveniently do so.

Very truly yours,

Edmund H. Halsey
Civil Engineer and Surveyor
Laurel Number 1-55

APPENDIX 2

CHECK LIST

VISUAL INSPECTION

DELAWARE LAKE DAM

Check List
Visual Inspection
Phase 1

Name Dam Delaware Lake County Warren State NJ (00127) Coordinators NJDEP

Date(s) Inspection 2/18/81, 4/22/81 Weather Sunny Temperature 35°, 65°

Pool Elevation at Time of Inspection 460 ft NGVD Tailwater at Time of Inspection 442 ft NGVD

Inspection Personnel:

W. Guinan
K. Stewart
D. Deane
C. Plaud
J. Stone
S. Gilman
R. Murdock

K. Stewart/S. Gilman Recorder

Harold Buckman, the owner, was present during the April 22 inspection.

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Surface of weir - Good condition ogee shape - apron broken at d/s end.	Recently capped
APPROACH CHANNEL	U/s end of left abutment training wall is spalled and eroded at waterline - 4-in deep. Face of abutment wall (left) is spalled. Right training wall has section cracked and settled and moved horizontally.	Repair spalling, erosion and cracks
DISCHARGE CHANNEL	Boulders, broken concrete, brush, and trees in channel. On right side, 18-in training wall for 52 ft d/s, concrete and earth training wall for 60 ft more. Right training wall has 4 vertical thru wall cracks. Surface of bottom of spillway - good. Lower end has a 2-in spalled off top.	Repair cracks
BRIDGE AND PIERS OVER SPILLWAY	Piers are in good condition. Steel girders are rusted.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None observed.	
INTAKE STRUCTURE	Not visible.	
OUTLET PIPE	12-in gate valve. Concrete valve pit.	
OUTLET CHANNEL	Steep, rocky bottom unobstructed.	
EMERGENCY GATE	12-in pipe with valve in concrete pit is in good condition. Bottom is dry. Wood plank cover is weathered.	In pit 18.5 ft deep

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Erosion of both upstream and downstream trees on downstream slope.	Repair erosion and provide adequate erosion protection.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Horizontal - good. Vertical - slight undulation of crest.	
RIPRAP FAILURES	Riprap missing at many locations along upstream face.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
RAILINGS	None.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Good.	
ANY NOTICEABLE SEEPAGE	Apparent seepage along toe near outlet pipe.	Investigate cause of seepage and specify appropriate remedial measures.
STAFF GAGE AND RECORDER	None.	
DRAINS	None.	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Gradual to steeply sloped, wooded, open fields.	
SEDIMENTATION	No significant sedimentation observed.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Rocky - 12-in dia. trees	
SLOPES	Steep to moderate heavily wooded.	
APPROXIMATE NO. OF HOMES AND POPULATION	One house with four people.	House is well above test flood elevation.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Plan #141 on record, NJ00127, from NJDEP files, New Jersey Department of Environmental Protection, Prospect Street, Trenton, New Jersey 08625. Used for plan and profile in Report - Figures 2 & 3.
REGIONAL VICINITY MAP	Prepared for this report.
CONSTRUCTION HISTORY	No recorded detailed description. Reference data, dams in New Jersey, NJ00127 from NJDEP files, is available in Appendix 1, ENGINEERING and EXPERIENCE DATA.
TYPICAL SECTIONS OF DAM	Plans filed 1 February 1929, approved 13 February 1929, and completed work in October 1929 were used for this report and are available from NJDEP files.
HYDROLOGIC/HYDRAULIC DATA	Available data found in Appendix 1, ENGINEERING and EXPERIENCE DATA.
OUTLETS - PLAN	Available from NJDEP files - see TYPICAL SECTIONS OF DAM above.
- DETAILS	Same as above.
- CONSTRAINTS	None found
- DISCHARGE RATINGS	None found
RAINFALL/RESERVOIR RECORDS	None found

ITEM	REMARKS
DESIGN REPORTS	None found
GEOLOGY REPORTS	None found
DESIGN COMPUTATIONS	Available data in Appendix 1, ENGINEERING and EXPERIENCE DATA
HYDROLOGY & HYDRAULICS	Same as above
DAM STABILITY	None found
SEEPAGE STUDIES	None found
MATERIALS INVESTIGATIONS	
BORING RECORDS	
LABORATORY	None found
FIELD	
POST-CONSTRUCTION SURVEYS OF DAM	None found
BORROW SOURCES	Unknown

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	None
HIGH POOL RECORDS	None
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None
MAINTENANCE OPERATION RECORDS	None

ITEMS	REMARKS
SPILLWAY PLAN	
SECTIONS	Prepared for this report from field inspection
DETAILS	None
OPERATING EQUIPMENT PLANS & DETAILS	1 gate valve Plan available from NJDEP files. See TYPICAL SECTIONS OF DAMS on page 2-8.

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 2.6 square miles, moderate slope, woods and fields

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 460' NGVD (307 acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY: Not applicable

ELEVATION SDF POOL: 461.8' NGVD (100-year unrouted)

ELEVATION TOP DAM: 462.1' NGVD

SPILLWAY CREST: Free overflow concrete spillway

a. Elevation 460' NGVD

b. Type Broadcrested concrete weir

c. Width 4 feet

d. Length 50 feet

e. Location Spillover At left abutment of dam

f. Number and Type of Gates None

OUTLET WORKS: One low-level outlet pipe

a. Type One 12-inch reinforced concrete pipe

b. Location 190 feet right of left abutment through base of dam

c. Entrance Invert Estimated at 442.3' NGVD

d. Exit Inverts 442.2' NGVD

HYDROMETEOROLOGICAL GAGES: None

MAXIMUM NON-DAMAGING DISCHARGE: 389 cfs

APPENDIX 3

PHOTOGRAPHS

DELAWARE LAKE DAM

April 22, 1981

Downstream face of overflow spillway. Note repaired concrete at left (east) side (right edge of photo).

April 22, 1981

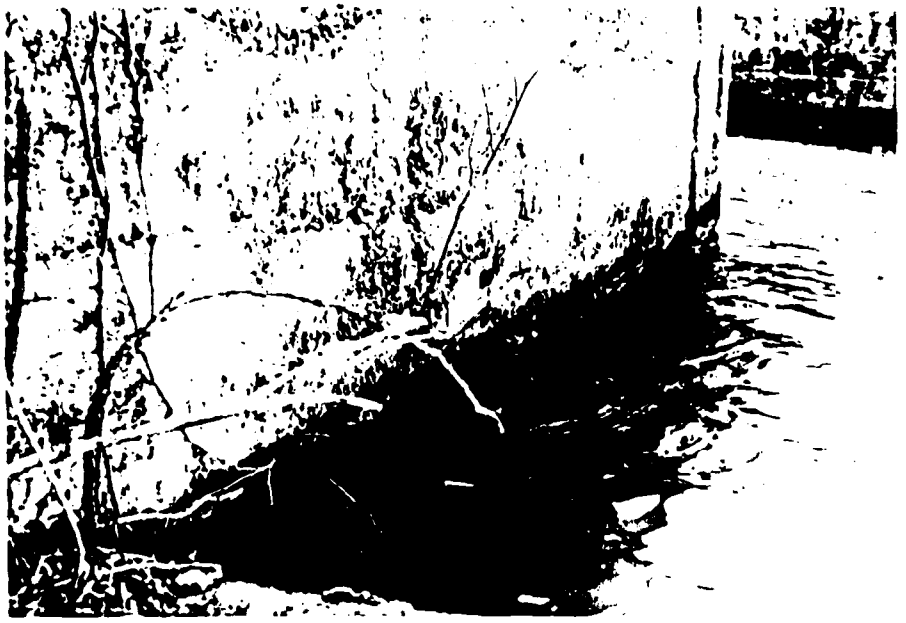
Right Spillway training wall running outward parallel to chute of spillway on downstream face of dam. Wall extends to the left (east) to meet wingwall.

April 22, 1981

Crack in training wall downstream of spillway.

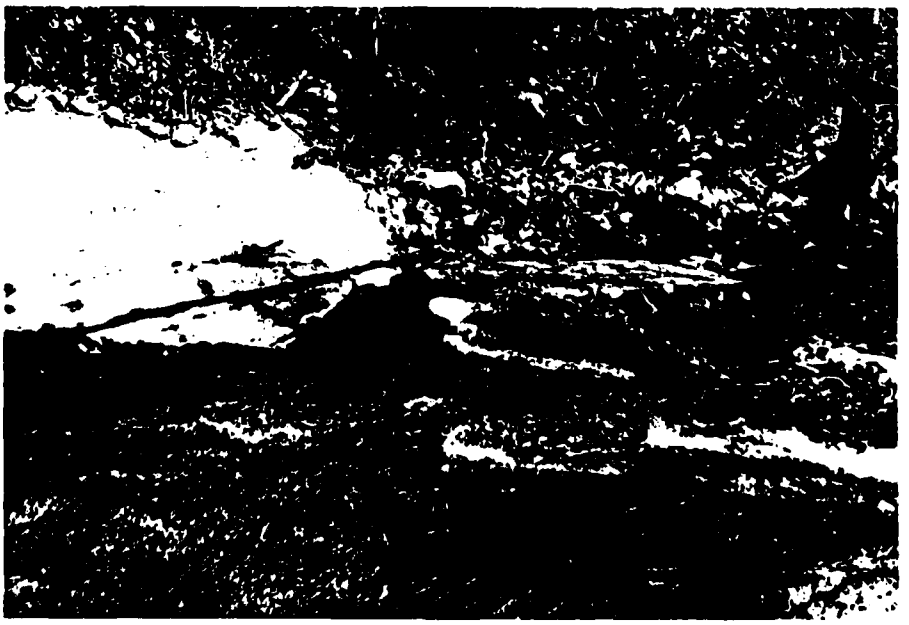
April 22, 1981

Trees adjacent to right spillway wingwall. Tree in foreground 10-in diameter.



April 22, 1981

Scoured and eroded concrete at water line on upstream training wall wing (left [east] side).



April 22, 1981

Repaired concrete near discharge point on left side of chute from spillway.

April 22, 1981

Apparent repairs to upstream face using concrete and sand. Note 8-inch ruts on dam crest from tire tracks.

April 22, 1981

Suggestion of sloughing or erosion near crest of downstream slope in vicinity of valve box, 17-inch escarpment.

April 22, 1981

Valve box near center, downstream, near crest. Ladder rusted and dangerous.

April 22, 1981

Looking upstream at exit portal of low-level outlet.

April 22, 1981

Erosion adjacent to low-level outlet (left [east] side).

April 22, 1981

Erosion on downstream face adjacent to outhouse; roots up to 2 inches in diameter exposed in erosion gully.

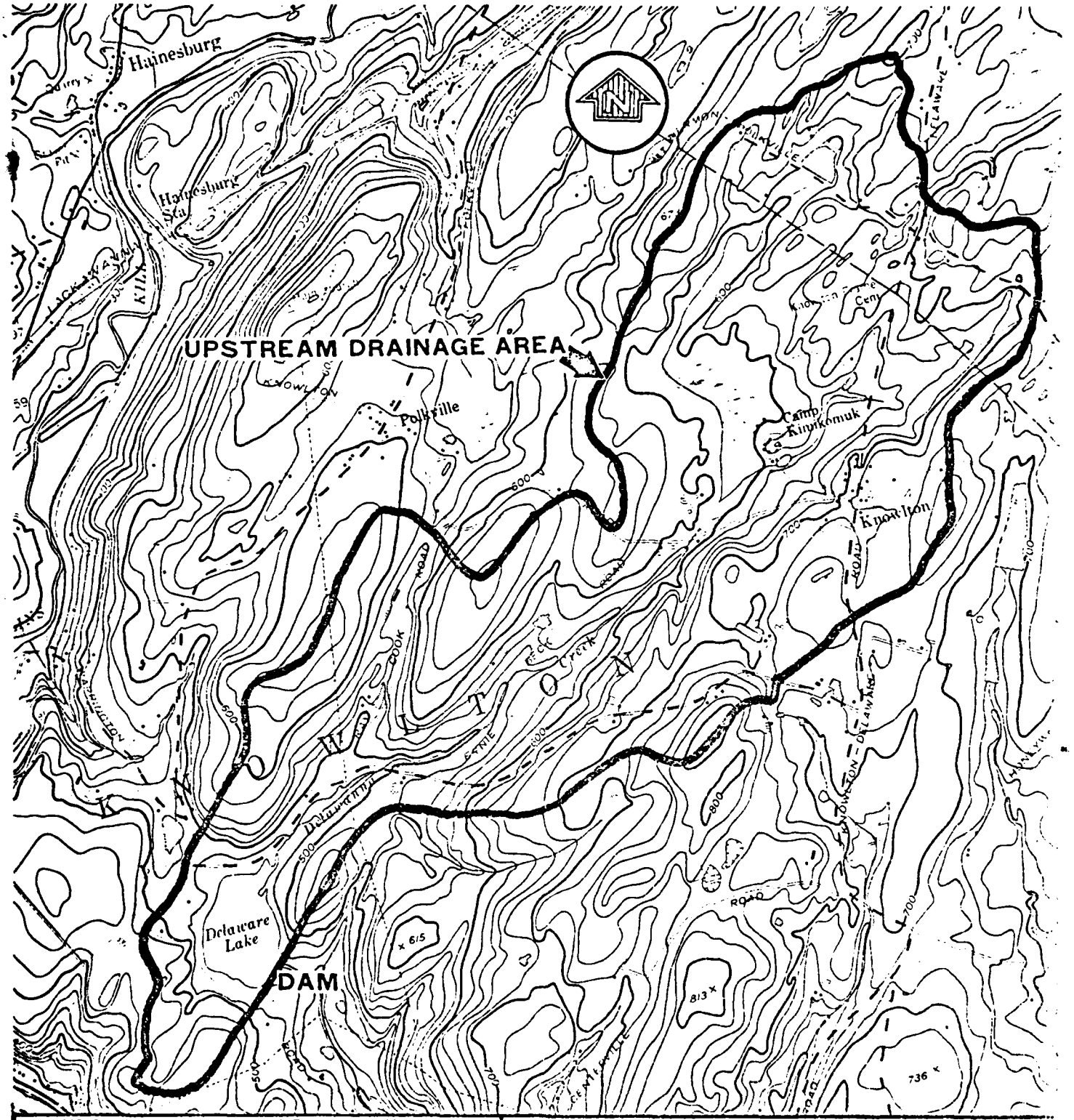
April 22, 1981

Downstream slope near outlet chamber, stream flow along the toe of dam. Note outlet pipe at foot of dam and valve box behind the trees near the crest.

APPENDIX 4

HYDROLOGIC COMPUTATIONS

DELAWARE LAKE DAM



NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

DELAWARE LAKE DAM

KNOWLTON TOWNSHIP, NEW JERSEY

REGIONAL VICINITY MAP

JUNE 1981

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

Anderson-Nichols & Company, Inc. BOSTON, MA.

SCALE IN MILES

0 1/2

MAP BASED ON U.S.G.S. 7.5 MINUTE QUADRANGLE SHEET. PORTLAND, N.J., PA. 1955, REVISED 1971.

Anderson-Nichols & Company, Inc.

Subject DELAWARE LAKE DAM

Sheet No. 1 of

Date 8 JUNE 1981

Computed KKS

Checked

JOB NO. 3670-07

SQUARES 1/4 IN. SCALE

STANKOWSKI EQUATION

$Q_{100} = 136 A^{0.84} S^{0.26} S_t^{-0.51} I^{0.14}$

$A = 2.58 \text{ mi}^2$

$S = \frac{605-470}{13200} = 0.01 \text{ ft/ft} = 53 \text{ ft/mi}$

$S_t = \frac{\text{803 ft. millrd}}{\text{16510 ft} \times \text{D.A}} = .048 = 4.8\% + 1\% = 5.8\%$

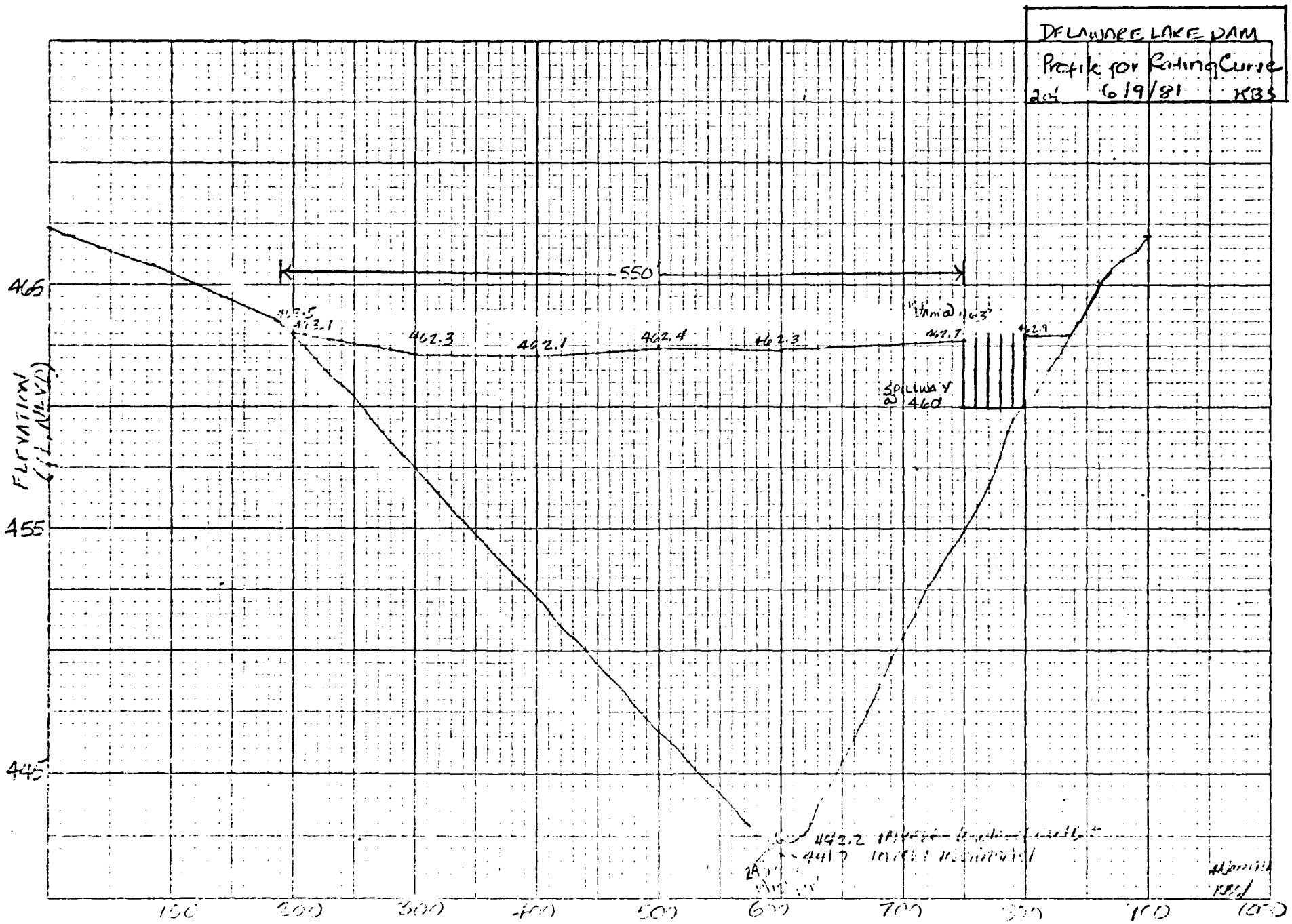
$I = 1\%$

$Q_{100} = 136 (2.58)^{0.84} (53)^{0.26} (5.8)^{-.51} (1)^{0.1} = 345$

$Q_{100} = 345 \text{ cfs}$

Spillway capacity from rating curve = 389 CFS

DELAWARE LAKE DAM
Profile for Rating Curve
2d 6/9/81 KBS



Anderson-Nichols & Company, Inc.

Subject DELAWARE LAKE DAM

Sheet No. 3 of

Date 6-4-81

Computed KLS

Checked CED

JOB NO.

SQUARES 1/4 IN. SCALE

DEVELOPMENT OF RATING CURVE

$Q = CLH^{3/2}$

① SPILLWAY CURVE

C = 2.7 BREADTH = 4'

weir length = 50 − 2.7(piers) = 47.3'

② TOP OF DAM

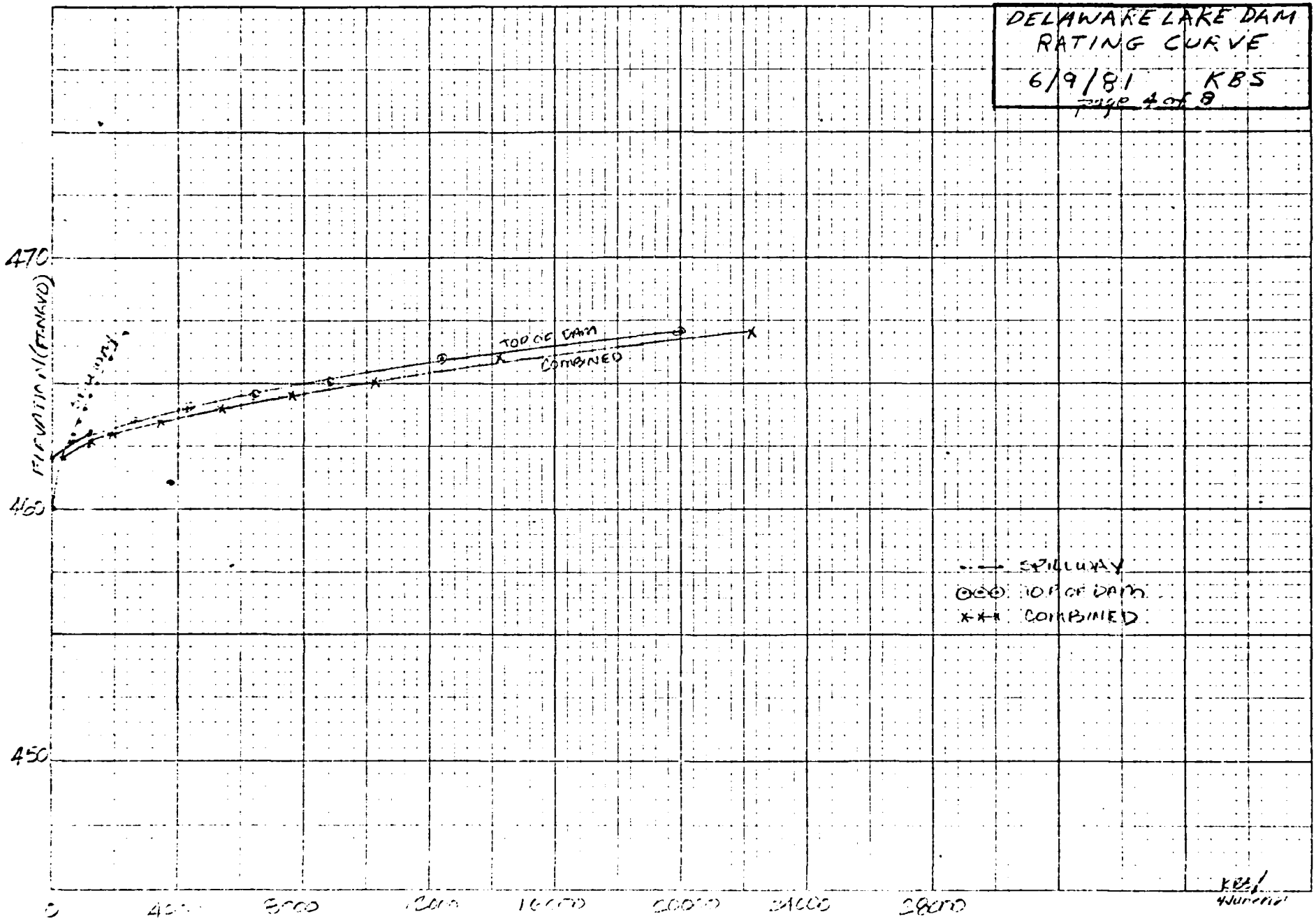
C = 2.6 BREADTH = 6'

weir length = 550'

	ELEVATION (FT-NGVD)	SPILLWAY		TOP DAM			TOTAL Q (CFS)
		HEAD (FT)	CFS	HEAD (FT)	LENGTH (FT)	Q (CFS)	
SPILLWAY	460	0	0				0
TOP DAM	462.1	2.1	389				389
	462.7	2.7	567	0.6	520	629	1195
	463.	3.0	664	0.9	550	1221	1885
	463.5	3.5	836	1.4	600	2584	3420
	464.	4.0	1022	1.9	630	4290	5312
	464.5	4.5	1219	2.4	665	6429	7648
	465	5	1429	2.9	690	8804	10233
	466	6	1877	3.4	760	12388	14265
	467	7	2365	4.4	830	19917	22282

DELAWARE LAKE DAM
RATING CURVE

6/9/81 KBS



KBS
4 June 81

Anderson-Nichols & Company, Inc.

Subject: Peckville Lake Dam

Sheet No. 5 of 9

Date

Computed

Checked

JOB NO.

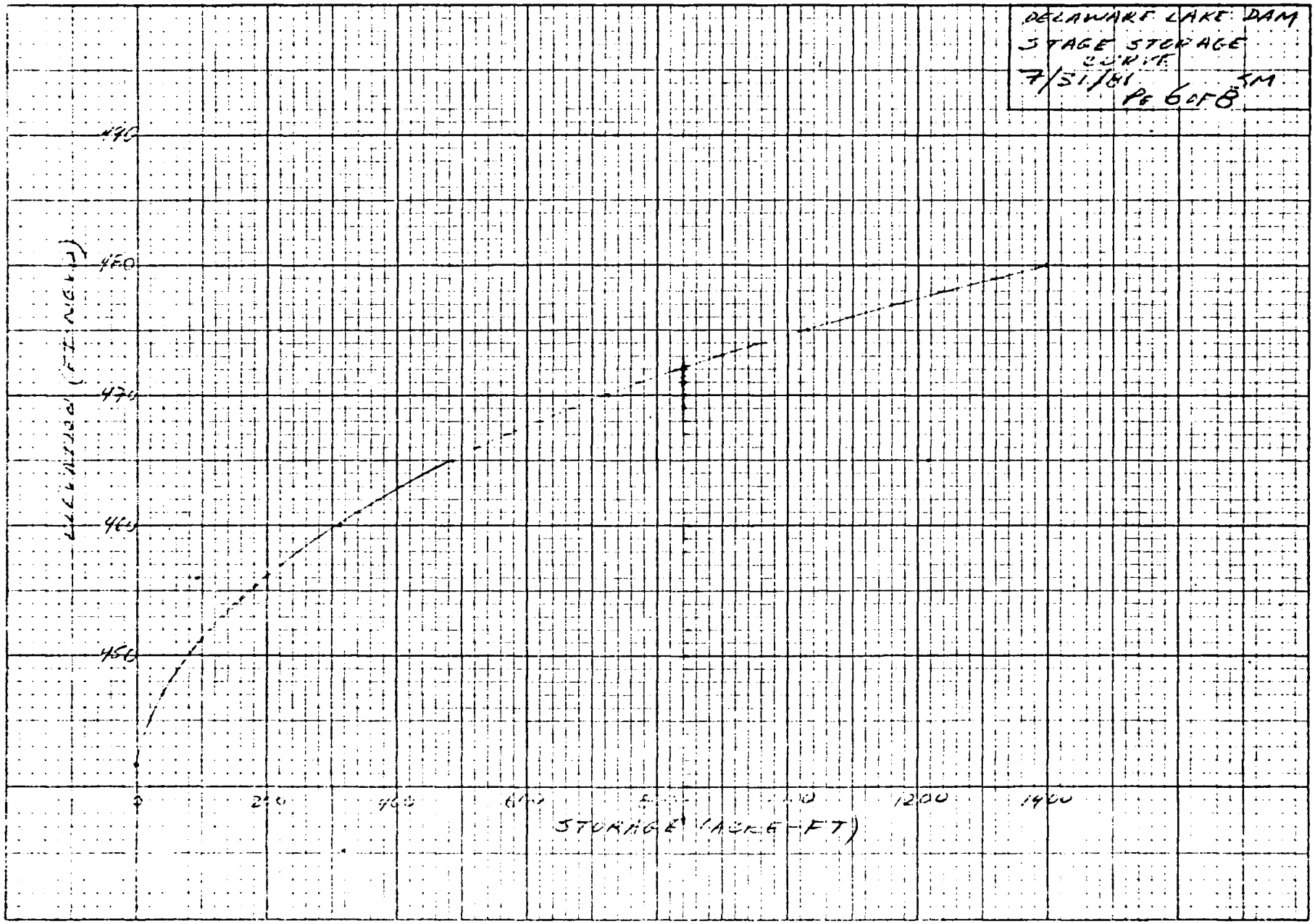
SQUARES 1/4 IN. SCALE

STAGE - STORAGE DETERMINATIONS

TAKE DEPTH OF LAKE TO BE 6'

ELEVATION Ft	SURFACE AREA ACRES	AVG SA ACRES	INCREMENTAL STORAGE	
		38.4	307.2	
460	38.4			307
		54.4	1088	
480	70.4			1395
		99.2	1984	
500	128			3379

STAGE	STORAGE
441.7	0
460.0	307
462.1	370
465.0	475
470.0	725
475.0	1050
480.0	1395



Anderson-Nichols & Company, Inc. Subject DELAWARE DAM Sheet No. 7 of 8

Date 6/

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JOB NO.

SQUARES 1/4 IN. SCALE

Determination of "C" for low level outlet

D = diameter = 12 inches

n = 0.015 reinforced concrete pipe (K & H [illegible])

A_p = area of pipe opening = .77 ft²

L_p = 70'

K_f = friction [illegible] pipe

$$K_f = \frac{6087\, n^2}{D^{16/3}} = \frac{6087\,(.015)^2}{(12)^{16/3}} = 0.008$$

K_L = entrance loss [illegible] pipe = 0.6 (K & H [illegible])

C_p = Coefficient of discharge

$$C_p = A_p \sqrt{\frac{2g}{1+K_L+K_f L_p}} = 0.79 \sqrt{\frac{64.4}{1+0.5+(.008)(70)}} = 2.9$$

$$C = C_p / A_p / \sqrt{2g}$$

$$= 2.9 / .79 / \sqrt{64.4} = 0.46$$

Anderson-Nichols & Company, Inc.

Subject DELAWARE LAKE DAM

Sheet No. 8 of 8

Date

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JOB NO.

Drawdown by low level outlet

Assume: (1) no significant inflow

(2) one 12" reinforced concrete pipe

(3) $Q_p = C_p H^{1/2} = 2.9 H^{1/2}$

(4) Acre ft/day = 1983 × Δ storage

(5) Days = Δ storage / Acre ft/day

Elev.	Storage (ac-ft)	Δs	H ft	Q c.f.s	Ave Q c.f.s	Acre-ft/day	Days
460	307		17.3	12.1			
		127			11.2	22.2	5.7
455	180		12.3	10.2			
		90			9.0	17.8	5.1
450	90		7.3	7.8			
		70			6.1	12.1	5.8
445	20		2.3	4.4			
		20			2.2	4.4	9.5
mid-point of pipe 442.7	0		0	0			

21.1 days

APPENDIX 5

REFERENCES

DELAWARE LAKE DAM

APPENDIX 5
REFERENCES

DELAWARE LAKE DAM

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